

Modular, high-performance system can power hybrid electric vehicles



O A A T A C C O M P L I S H M E N T S

High-Power Lithium-Ion Battery

Challenge

Hybrid electric vehicles (HEVs) hold the promise of meeting the Partnership for a New Generation of Vehicles (PNGV) goal of an 80-mpg mid-size vehicle. To achieve that goal, HEVs require batteries that meet stringent performance, safety, and cost targets, which research has shown that only lithium-based batteries and nickel-metal hydride batteries can meet.

Technology Description

U.S. Department of Energy researchers worked with industry to develop a lithium-ion battery that achieves high power in an integrated system small enough to fit inside a mid-size vehicle engine compartment. The design integrates temperature, battery management, and cell balancing systems. Based on DaimlerChrysler Corporation's predecessor proof-of-concept ESX3 battery, the lithium-ion unit employs a modular design allowing battery packs to be located separately from the battery's management systems.

The electrodes meet stringent PNGV requirements for round-trip energy efficiency, power, and cycle life.

Achieved pulse discharge power of 25 kilowatts (kW) and peak regenerative pulse power of 30 kW in a 276-volt system. Discharge and regeneration capabilities were optimized to achieve the required 0.3 kWh total available energy.

An air-cooled system was developed to control temperature.

Individual cell voltages are monitored to ensure proper cell and battery pack operation.

Battery management, based on cell balancing, is applied to both charging and discharging regimes, and includes communication with the vehicle controller.



Integrated high-power lithium-ion battery pack.

Contacts

Raymond Sutula
Team Leader/Manager,
Energy Management
202-586-8064
202-586-1600 fax
raymond.sutula@ee.doe.gov

Guy Chagnon
Manager, HEV Programs
SAFT America, Inc.
410-771-3200
410-771-0234 fax
guy.chagnon
@saftamerica.com

Accomplishments

Researchers developed a compartmentalized, integrated design that fits easily into available vehicle space. When space is more limited, the battery packs can be located away from the battery management system and high-voltage thermal management unit.

Benefits

The compact, integrated, lithium-ion battery system meets stringent performance specifications in a safe and reliable manner, and provides enough power to allow HEVs to compete with conventional vehicles.

Commercialization

DaimlerChrysler Corporation developed a predecessor ESX3 battery that demonstrated the flexibility of lithium batteries and the viability of a separate battery management shelf design adjacent to the battery packs. SAFT America, Inc. improved on this design with its 276-volt lithium-ion battery system.

Future Activities

To meet or exceed PNGV specifications, researchers will continue optimizing cell and battery designs, focusing on reductions in size and cost of the lithium-ion battery system. Life evaluation tests will also be conducted to verify, at the battery level, system performance in vehicles.

Manufacturing process improvements will be pursued and industry partners will work with electronics component suppliers to reduce materials costs.

Partners in Success

- DaimlerChrysler Corporation
- SAFT America, Inc.

